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Ribbed Mussels Offer Possible Natural Way to Improve Urban Water Quality

Pilot Study in New York City's Bronx River Explores Use of Nutrient Bioextraction

Using a 20-foot by 25-foot mussel raft in New York City's Bronx River as their field location, researchers from the Northeast Fisheries Science Center's (NEFSC) Milford Laboratory in Milford, Conn., have begun a two-year pilot study to test how effectively ribbed mussels (*Geukensia demissa*) remove nitrogen and other excess nutrients from the water. Scientists are monitoring the condition of the mussels, which are growing on lines hanging below the raft, as well as local water quality over time to see how each responds.

Farming and harvesting shellfish and seaweed to remove nitrogen and other excess nutrients from estuaries and coastal waters is known as nutrient bioextraction, or bioharvesting. Mussels and other shellfish are filter feeders, and as the organisms grow, they take up or assimilate nutrients in algae and other microorganisms filtered from the surrounding waters. When harvested, the nutrients in the shellfish or seaweed are removed directly from the environment.

the mussel raft study is part of long-term efforts to improve water quality in Long Island Sound. The pilot project will evaluate the potential for mussel aquaculture to increase biological filtration activity in an urban environment. If successful, similar operations could be used elsewhere. Results from the pilot study will also contribute to a system-scale evaluation of bioextraction use for all of Long Island Sound and work to characterize the ecosystem services that would be provided by this approach, such as improvements in water quality, removal of bacteria, and assimilation of nutrients.

Traditional methods to reduce nutrients include upgrading sewage treatment plants and reducing storm water runoff that carries fertilizer and pet waste from the land into estuaries and coastal waters, reducing water quality. Loss of sea grass, algal blooms and hypoxia, or low oxygen levels in the water, can occur as consequences of over-fertilization. Nitrogen and other nutrients occur naturally in the coastal environment, but too much of any of them is harmful.

In addition to NOAA, project partners include The Long Island Sound Study, which has funded the installation and maintenance of the mussel raft off Hunt's Point in the South Bronx, near the confluence of the Bronx and East rivers. Rocking the Boat, a local youth development organization in the South Bronx, built and installed the raft in the Bronx River with support from Pemaquid Mussel Farms, a commercial shellfish company from Maine. Montclair State College in New Jersey is evaluating the diversity of sea life that will attach to the raft's mussel lines. The National Fish and Wildlife Foundation is providing project management with funding from the New York State Office of the Attorney General. EPA is providing funding for the system-scale modeling and ecosystem services work through their Regional Ecosystem Services (REServ) program.

“The open-frame mussel raft with ropes to catch and grow mussels was installed on site August 15 and is monitored on a regular basis,” said Julie Rose, a plankton biologist with the Milford Lab’s Culture Systems and Habitat Evaluation Branch. “We hoped to get it in the water before the mussels’ fall spawning season. It took a while to obtain all the permits and work out all the logistics. The raft itself is located in a pretty interesting place, not far from a large sewage treatment plant but in an area where there is not a lot of traffic on the water or the shoreline. All the action is underwater.”

Lab staff visit the raft on a regular basis, checking lines for natural mussel growth during fall spawning season, which occurs in September. Mussels also spawn in the spring when the water temperatures warm and plankton and other sources of food become more plentiful.

Atlantic ribbed mussels (*Geukensia demissa*) occur naturally in the area and once thrived in local salt marshes and along the shoreline, but as urban development degraded the marshes or eliminated them altogether, fewer ribbed mussels survived. Current mussel populations are too sparse to have the capacity to filter microorganisms fertilized by high nutrient levels. Rose is optimistic the raft will be populated by mussels next spring, either with new mussels from the fall/spring spawn or existing mussels populating the local rivers.

“Ribbed mussels have no commercial market,” said Rose. “They aren’t something anyone eats because they have an unpleasant taste, but they may have some future commercial value, such as an alternative chicken or fish feed.”

The Milford team conducted an on-site mussel filtration experiment October 21 at the Bronx River location. National Research Council postdoctoral scholar Eve Galimany has been funded by the NOAA Aquaculture Program to work with Milford Lab staff on the mussel-filtration component of the study. Galimany recently completed a Ph.D. project at the University of Barcelona in Spain where she developed the innovative apparatus and procedure to quantify mussel filtration activity that she has used this summer in the Bronx River.

Of the ribbed mussels in the Bronx River, Galimany said. “They are dealing with a lot of silt in the water, but seem to be removing the organic fraction pretty effectively.” Several datasondes, an instrument used to monitor water quality, have been measuring such factors as temperature, salinity, oxygen levels, algae and turbidity in the river.

“This project in the Bronx River is one of the first to test the effectiveness of a relatively new technology,” said Gary Wikfors, Milford’s Biotechnology Branch chief and NEFSC project leader for the mussel study. The idea has been successful in other countries, and if the pilot study goes well, shellfish aquaculture for nutrient removal could be applied in many other coastal environments.”

“There is already considerable local interest in and ‘buzz’ about the project,” Rose said. “We don’t have any results yet since the project just got underway. The raft survived Hurricane Irene just days after it was installed in the river, and things have gone well so far, so we’re off to a good start.”

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Related links:

Long Island Sound Study: Nutrient Bioextraction Overview:

<http://longislandsoundstudy.net/issues-actions/water-quality/nutrient-bioextraction-overview/>

Rocking the Boat: <http://www.rockingtheboat.org/>

Milford Laboratory: <http://mi.nefsc.noaa.gov>